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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/511,865

Filing Date: March 10, 2005

Appellant(s): LO ET AL.

Jonathan Myers
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 2/10/2009 appealing from the Office action
mailed 6/24/2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

3,259,532	Gray Reynolds William	07-1996
3,137,127	Grosse Aristid V; et al.	06-1964
5,529,648	Stickler, David B	06-1996

3,691,769	Keilbach et al.	09-1972
5,834,539	Krivojlavek, Dennis	11-1998

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 17, 19, 22-31, 33, 34, and 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reynolds (US Patent No. 3,259,532) in view of Grosse et al. (US Patent No. 3,137,127) in further view of Stickler (US Patent No. 5,529,648).

Regarding claims 17, 19, 22-27, 30, 31, 33, and 37-39

Reynolds teaches the use of a carbonaceous substance dispersed in liquid oxygen. This mixture is then incorporated into the interstices of a metal sponge that inherently has hollow spaces of a size that would affect the combustion speed (preferably aluminum or magnesium) (column 1, line 44 to column 2, line 5).

Although, Reynolds does not teach the use of an open pore plastic foam, Reynolds does teach the use of open pore metal foams. However, because Stickler teaches a rocket engine having a continuous solid matrix, which compares to the metal foam of Reynolds as it is also a continuous solid matrix fuel, and teaches that this is preferably a combustible polymeric material, such as HTBP (column 4, lines 38-60), it would have been *prima facie* obvious to one of ordinary skill in the art at the time of invention to modify the basic teaching of Reynolds by substituting a plastic material for the metal material of the foam of Reynolds, with a reasonable expectation of success, as suggested by Stickler, and further taking into account that the skilled artisan would appreciate that 1.) A plastic would be lighter than a metal, and give weight benefits to a

rocket and 2.) The skilled artisan would appreciate that polymers being of high molecular weight, give much benefit to rockets as it understood that there will be a great entropy effect generated by the loss of order and gain of randomness associated with combustion of very large molecules, and would serve to increase the impulse of the engine. 3.) In the art of energetic materials it is well understood that both metals and polymers (organics) can act as fuels, and it is obvious to substitute one component for a given use for another component for that same use, absent any evidence of unexpected results.

Although, Reynolds does not explicitly disclose the freezing of the liquid oxygen to form a solid monergole propellant, Reynolds does disclose that the liquid oxygen suspension can be incorporated into the interstices by either directly pouring of the suspension onto the sponge or by immersing the sponge in the suspension (column 2, line 34 to column 2, line 49). However, because Grosse et al. disclose the use of a fuel/oxidizer or both that are normally gaseous or liquid at room temperature being frozen solid for use as a rocket motor (column 1, line 14 to column 1, line 47) giving the advantage of having a high specific impulse as normal for liquid fuel engines without the typical draw backs such as extra plumbing, valves, and separate containers for the fuel and oxidizer associated with liquid fuel rocket engines (column 1, line 48 to column 2, line 6), It is *prima facie* obvious to combine two or three compositions, each taught for the same purpose to yield a third composition for that very purpose. *In re Kerkhoven*, 205 USPQ 1069, *In re Pinten*, 173 USPQ 801, and *In re Susi*, i69 USPQ 423.

Also, it would have been obvious to someone of ordinary skill in the art at the time of the invention to change the size of the hollow spaces in the sponge, thereby affecting the rate of combustion by changing the surface area, since the reaction kinetics of solid reactants are primarily controlled by the available surface area of said reactants. As to limitations which are considered to be inherent in a reference, note the case law of *In re Ludke*, 169 USPQ 563; *In re Swinehart*, 169 USPQ 226, *In re Fitzgerald*, 205 USPQ 594; *In re Best et al*, 195 USPQ 430; and *In re Brown*, 173 USPQ 685,688.

Regarding claims 28, 29, 34, 40, and 41

Neither Reynolds nor Grosse et al. explicitly disclose the use of an initially encapsulated liquid that is then bonded with the solid structure then frozen. However, because Stickler teaches the use of a dispersion of encapsulated liquid within a solid fuel matrix (column 3, line 60 to column 4, line 5) and Grosse et al. disclose the use of a fuel/oxidizer or both that are normally gaseous or liquid at room temperature being frozen solid together for use as a rocket motor (column 1, line 14 to column 1, line 47), it is *prima facie* obvious to combine two or three compositions, each taught for the same purpose to yield a third composition for that very purpose. *In re Kerkhoven*, 205 USPQ 1069, *In re Pinten*, 173 USPQ 801, and *In re Susi*, i69 USPQ 423.

Claims 18 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reynolds (US Patent No. 3,259,532) in view of Grosse et al. (US Patent No.

3,137,127) in view of Stickler (US Patent No. 5,529,648), as applied to claims 17, 19, 22-31, 33, 34, and 37-41 above, in further view of Krivohlavek (USP 5,834,539).

Although, neither Reynolds nor Grosse et al. teach the use of an emulsion of liquids that are not soluble together, Reynolds and Grosse et al. teach the rest of the limitations of the claims. However, because Kreivohlavek teaches that energetic materials comprising emulsions burn, combust, or explode with greater efficiency (column 1, lines 34-38), it would have been obvious to someone of ordinary skill in the art at the time the invention was made to combine the teachings of these three references with a reasonable expectation of success and the expected benefit of producing a more efficient rocket propellant.

Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Reynolds (US Patent No. 3,259,532) in view of Grosse et al. (US Patent No. 3,137,127) in view of Stickler (US Patent No. 5,529,648), as applied to claims 17, 19, 22-31, 33, 34, and 37-41 above, in further view of Keilbach et al. (US Patent No. 3,691,769).

Although, neither Reynolds nor Grosse et al. explicitly disclose the use of a protective coating on the solid phase to chemically insulate the two reactants from one another. However because Keilbach et al. disclose that metals when mixed with an oxidizer in a rocket engine need to be protected from oxidation (column 4, line 16 to column 4, line 33), it is *prima facie* obvious to combine two or three compositions, each taught for the same purpose to yield a third composition for that very purpose. In re

Kerkhoven, 205 USPQ 1069, In re Pinten, 173 USPQ 801, and In re Susi, i69 USPQ 423.

(10) Response to Argument

Claims 31, 33, 34 and 37 through 41 directed to.....

Appellants argue that none of the reference alone or in combination teach Appellants structure where a plastic foam fuel completely encompasses an oxidizer in the form of a cryogenic solid.

This is not persuasive as the primary reference of Reynolds clearly teaches the use of liquid oxygen dispersed into the interstices of a metal sponge (it is noted that the reference teaches that open-pore foams are equivalent to sponges, and differ from closed pore sponges), and Grosse provides motivation for freezing solid the liquid oxidizer (see rejection), upon appellants amendment to the claims to exclude the use of metal fuel and use plastic fuel, the reference of Stickler was added to show that it would have been obvious to substitute a metal fuel for a plastic fuel (it is noted that both metal and plastic sponges are well known), and it is noted that appellants have failed to argue as to why this reasoning is improper.

Appellants argue that Reynolds "proceeds on the basis of an explosive mixture that must be brought to detonation with an electrical spark", then follow by stating that Reynolds also teaches "Consequently, the object of the invention (see column 1, lines 44-49) is to provide a new combustion system that combines the advantages of a

combustible metal with the advantages of liquid oxygen into an explosive agent, PROPELLANT or an explosive composition. Here it is noted that appellants admit that the reference of Reynolds teaches that the composition can be used as a propellant, and there is good reason to substitute a metal fuel for a plastic fuel in a propellant (see rejection).

Appellants argue that "Reynolds solves this problem with a rigid metallic sponge, not a foam".

This argument is not persuasive, and it is noted that appellants have submitted this argument before and it has been noted and responded to in the non-final, filed 11/15/2007 where it was stated under response to arguments "Applicants argue that the open pore foam of the instant application is different from the metal sponge used by the reference, however the reference teaches that the difference between a sponge and a foam is whether the pores are connected or not, and since the pores of both the reference and the instant application are both open they have identical structure, although, applicants can be their own lexicographers and define terms as they see fit, they can not change the definition of terms from the reference", it is also noted that the reference specifically teaches " By the term metal sponge is meant a rigid metal matrix which contains distributed throughout its inner portion, in a generally uniform manner, a multiplicity of discrete interconnecting cells or pores, which communicate with each other. This material is to be differentiated from metal foams in which the pores do not interconnect or communicate. Such metal sponge is known and is employed, for

example in porous filler and porous metal bearings. The interconnected cells allow the free passage of liquid or gas, as well as the sifting into the interstices of the metal sponge, of finely divided materials" (column 1, lines 52-63). This clearly shows the differentiation between closed pore foams and open pore foams (sponges), where sponges are equivalent to the open pore foam of the instant invention. It is also noted that appellants have failed to respond to this argument.

Appellants argue that this explosive mixture is used as an explosive agent, combustible matter or explosive composition.

Here it is also noted by the examiner and even recognized by appellants that the composition can be used as a propellant.

Appellants argue that in their invention both the fuel and the liquid are present in a solid phase.

While this may be true this ignores that fact that the reference of Grosse teaches the use fuel/oxidizer or both that are normally gaseous or liquid at room temperature being frozen solid for use as a rocket motor, with specific advantages, which was included as part of the rejections has been ignored by these arguments, making them improper piece meal analysis of the references.

Appellants argue that metallic foams and synthetic foams are different materials.

This is acknowledged, but does not address the rejection/references/knowledge generally available to one of ordinary skill in the art, which show that it would have been obvious to one of ordinary skill in the art at the time of invention, to substitute a metal fuel for a plastic (synthetic) fuel, and the reasons that this would be done. Again appellants have failed to address the arguments presented by the examiner, and instead of arguing the rejection, offer mere allegation as to what would or would not have been obvious to one of ordinary skill in the art at the time of the invention.

Appellants argue that "The properties of the liquid oxidation agent in Reynolds, which is dispersed and mixed with carbon, and the solid oxidation agent of the invention are also basically different".

This is not persuasive because while it is acknowledged that Reynolds teaches liquid oxidizers, where the instant invention teaches solid oxidizers, however, the oxidizers are the same, and this argument fails to acknowledge that the rejection is based on a combination of references, and as such this amounts to improper piecemeal analysis of the references.

Appellants further argue here that as temperatures decreases the density increases and the volume decreases (this is basically true), "thus a person skilled in the art must expect significant problems as a result of the decrease in volume if he wants to apply solid/liquid systems in the low temperature range. He must expect that the systems will lose their homogeneity and that the deflagration properties will deteriorate. Because of these facts, a person skilled in the art will not readily replace the solid/liquid

system of Reynolds with a cryogenic solid/solid system according to the presently claimed invention"

This is not persuasive for at least the following reasons:

1.) Appellants have offered no evidence other than mere allegation that, one "must" expect "significant" problems, when changing the temperature to solidify the composition, and the fact that the composition is held in a matrix, would suggest against this. If appellants have information that would be relevant to this discussion other than mere allegation, that appellants consider pertinent and relevant to patentability, as to why one would expect problems when solidifying the liquid oxidizer, this is kindly requested. It is further noted that as the liquid oxidizer is lowered in temperature and the volume decreases, so to will the volume of the solid fuel.

2.) In the instant invention the liquid oxidizer is also frozen to be solid, and there appears to be no detrimental affects. If appellants choose to pursue this route, why would it not be obvious to one of ordinary skill in the art at the time of invention, to pursue this route based on the teachings of the applied references and the knowledge generally available to one of ordinary skill in the art?

3.) Why would the system lose its homogeneity, do appellants propose that the matrix will dissolve, or that the oxidizer will precipitate?

4.) What evidence or teaching other than mere allegation is there to support the argument that the deflagration properties will deteriorate? If so how do appellants avoid this problem?

5.) The combination of references teaches the use of a liquid oxidizer in a fuel matrix, and the solidifying of liquid fuel/oxidizers or both, and appellants have not argued why this combination would be improper.

6.) It is noted that liquid oxygen is cryogenic, as argued in previous office actions, however, it appears that appellants have continued to ignore this, so it is respectfully requested, how would liquid oxygen not be expected to be cryogenic?

7.) How would the solidifying of liquid oxygen not be considered to be cryogenic?

8.) Is there some aspect of cryogenic that the examiner is not aware of? The examiner was under the understanding that cryogenics related to things that are very cold (i.e. lack of heat) or materials that can absorb large amounts of heat such as dry ice, liquid nitrogen, liquid oxygen, liquid argon, liquid helium, etc. If the examiner is incorrect in this understanding, a proper definition/ explanation is politely requested to clarify the misunderstanding.

Appellants argue that the problem to be solved by the presently claimed invention is also a different one from that claimed in Reynolds.

This is not persuasive and again appellants are reminded that the rejections are based on a combination of references, and this amounts to improper piece meal analysis of the references.

Appellants argue that Reynolds does not offer a skilled person in the art any suggestion to exchange the metallic sponge for an open-pored synthetic foam, and to exchange the liquid oxidation agent for a solid oxidation agent.

This is not persuasive and again appellants are reminded that the rejections are based on a combination of references, and this amounts to improper piece meal analysis of the references.

Appellants argue against the reference of Grosse individually.

This is not persuasive because these arguments do not take into account that fact that the rejection is based on a combination of references, and further these arguments fail to persuasively argue as to why one would not combine the references in the manner suggested in the rejection.

Appellants argue that "This is also the reason why the prior art, including Grosse et al, which has been known since June 16, 1964, was not utilized.

This is not persuasive because the length of time a fact was known does not make it less relevant to the patentability of the instant claims, and actually conversely would be contrary as this would be known, and most patents do not teach what is well known.

Further appellants argue that this solution of Grosse is inoperative.

This is not understood and it appears that if the combination is inoperative, then the instant invention would also be inoperative.

Appellants further argue against the reference of Grosse, but these arguments are considered to be improper piece meal analysis of the references, as they are not directed towards the rejection, which is based on a combination of references, or why it would have been improper to combine in the manner suggested in the rejection.

Appellants argue that there are a number of technical difficulties that must be overcome to arrive at the instant invention if he wants to apply the cryogenic temperatures to synthetic sponges. These technical difficulties include the following:

Frozen synthetic materials are brittle and have mechanical properties that make them unsuitable for the requirements in rocket propulsion systems such as stability against acceleration forces, resistance and vibrations,

This is not persuasive because appellants have not shown how they would overcome these difficulties, so it appears that either the disclosure is not enabled or that there is no real difficulty.

Appellants further argue that "there is a decrease in the volume of the liquid oxidation agents in their transfer into the frozen phase which may result in the loss of homogeneity and the combustion properties, which cannot be neglected, and"

This is not persuasive because there is also a decrease in the fuel volume, and applicants have failed to argue as to why a liquid oxidizer in a solid fuel matrix upon solidification of the liquid oxidizer would result in loss of homogeneity and combustion properties. Again it appears that appellants offer no more than mere allegation. If

applicants have some evidence to prove this, they are respectfully requested to share this information so that it can be evaluated for relevance to patentability. Further if such is true, how do appellants overcome such issues? As stated above it appears that either the disclosure is not enabled or that there is no real difficulty, as alleged.

Appellants argue further still "thermodynamic phase conversions in the freezing of liquid oxidation agents may cause unexpected changes in the properties of the oxidation agent."

This is not persuasive because the changing of properties of liquid oxidizers such as liquid oxygen are assumed to be understood, and appellants have failed to explain how they overcome these problems, so as stated repeatedly above, it appears that either the disclosure is not enabled or that there is no real difficulty. Further if there was some unexpected event or property change this would be relevant to patentability, however, appellants argue down that path that there might be some unexpected result, but offer no evidence and only allegation. Further still the references and the instant specification offer no teaching of unexpected results. Finally, that there might be unexpected results does not teach away from the suggestion of freezing or the reasons offer for doing so, and the legal standard is whether there is a reasonable expectation of success, not whether there might be some unexpected result that does not appear to happen as alleged by appellants.

Appellants argue that the particles of Grosse require a continuous spark.

While this may be true, appellants are again reminded that the rejection is based on a combination of references, and there is not reason offered that would have led one of ordinary skill in the art to believe that liquid oxygen frozen in a solid fuel matrix, whether that be a metal or synthetic, would require a continuous spark to maintain combustion, other than mere allegation. It is further noted that most solid rocket propellants do not require continuous ignition.

Appellants continue to argue against the reference of Grosse individually, which is considered to be improper piece meal analysis of the references.

Appellants argue against the reference of Stickler.

These arguments have been fully considered, but are not persuasive as the appellants have argued against the references individually, further appellants have failed to persuasively argue as to why one of ordinary skill in the art would not have combined the references in the manner suggested in the rejections (i.e. appellants have again ignored the rejections in an attempt to show that each reference individually does not disclose all of the limitations of the instant application).

Appellants argue that Stickler teaches away.

This is not persuasive and appellants are reminded that for a reference to teach away there must be some teaching or suggestion that the proposed combination will not work, a teaching of more preferred embodiments or that the specific combination is not preferred is not sufficient. It is noted that the examiner can find no such teaching or

suggestion, and again appellants have failed to provide any evidence other than mere allegation.

Appellants argue "The examiner is of the opinion that a person skilled in the art would arrive at the presently claimed invention by combining Reynolds, Grosse et al and Stickler in, and that this combination is obvious. Aside from the fact that the Examiner has applied a total of five prior art references, from five widely divergent fields, to support his argument that the presently claimed invention is obvious, in fact an analysis of these five references would indicate that the presently claimed invention would not have been obvious to those "skilled in the art."

This is not persuasive for at least the following reasons:

- 1.) First the primary rejection over the independent claims is using three references and not five.
- 2.) No rejection used a total of five references.
- 3.) Appellants have not provided any legal teaching that would suggest that the use of 5 references somehow detracts from what the references teaches or what the person of ordinary skill in the art would be expected to be capable of.
- 4.) Appellants have not persuasively argued why these are widely different fields, as they are all related to energetic materials and most if not all teach the use as propellants, further it is well known that many energetic materials can be used as either explosives or propellants, depending on the conditions of use.

5.) Appellants give no persuasive analysis as to why it would not have been obvious to combine the references as suggested, but again only offer mere allegations of patentability.

Appellants continue to argue against the reference of Stickler individually, which is considered to be improper piece meal analysis of the references.

Appellants argue that one cannot take individual characteristics from each of several references, cited in combination, without taking into account their means-effect correlation and without making significant changes to the present solutions that represent the state of the art.

This is not persuasive because it still does not persuasively argue that there is any specific problem with the combination, or why one of ordinary skill in the art would not have found it obvious to make such combination.

Appellants argue that the solutions to Reynolds, Grosse et al and Stickler, which proceeds from a retrospective look with knowledge of the invention, does not take into account that the solutions of Reynolds and Grosse et al date back to 1964 and 1965.

This is not persuasive because it is not understood how the length of time something was known makes it more novel in the present. Do appellants suggest that one inventing black powder in the present would be making a novel invention because it was discovered by the Chinese around 2000 years ago, and is old and dated?

Appellants continue to argue against the reference of Stickler individually, which is considered to be improper piece meal analysis of the references.

Appellants argue "The examiner argument, i.e., that a synthetic foam may be an advantage relative to the metallic sponge in Reynolds because of more entropy, negates the fact that the metallic sponge and synthetic foams represent different materials, that in particular the synthetics are much more brittle in the low temperature range, and that their suitability as combustible material for a rocket engine follows from their elasticity relative to vibration and jolt sensitivity in acceleration thrust. It is absolutely clear to every person skilled in the art that synthetics are brittle in the low temperature range and that, unlike the Examiner's view, it is not only the economic advantage that must be taken into account."

This is not persuasive for at least the following reasons:

1.) It is acknowledge that metal and synthetics are different, however this does not address the fact that the combination of references teaches that they are functionally equivalent, or the reasons and motivation to combine.

2.) Appellants have not shown that synthetics would be more brittle than metallics in the low temperature range, and it is noted that all materials would be expected to be more brittle in the low temperature range, so this is not unexpected, and would also occur in the instant invention.

3.) The economic view is not the only view that was taken not account.

Specifically the entropy, lighter in weight giving weight benefits, and it is understood that both metals and plastics (polymers/organics) can act as fuels in energetic materials.

The examiner had not taken into account the possible cost savings, nor had the examiner taken into account the fact that an organic/polymer will produce more gas as a fuel than will a metal, giving more thrust to a given rocket engine, which are also reasons one of ordinary skill in the art would have been motivated to exchange one fuel for another with a reasonable expectation of success and the expected benefit of making a more powerful rocket engine.

4.) Appellants have not submitted any evidence other than mere allegation to support their arguments.

5.) Appellants have failed to show/teach/suggest how they overcome these problems if again they are indeed problems.

Appellants continue to argue against the reference of Stickler individually, which is considered to be improper piece meal analysis of the references.

Appellants argue that "The Examiner's interpretations of the Stickler reference, and its combination with Reynolds and Grosse et al significantly differs from that of Appellants"

While this may be true it does not establish the proposed combination of references, is in anyway defunct or incomplete/incorrect or not within the level of one of ordinary skill in the art.

Appellants argue that they do not agree with the examiners understanding of the references.

This may be true but does not add to the patentability of the instant claims, as patentability is based more on facts than opinions, and the examiner believes that the arguments above weight the preponderance of evidence in his favor.

Appellants remaining arguments in this section have been fully considered, but are not persuasive for the same reasons given above.

Claims 17, 19, 22 through 30, directed to.....

Appellants argue that none of the cited references disclose or suggest in combination the claimed invention. This is not persuasive for the same reasons given above.

Appellants continue to argue against the reference of Stickler individually, which is considered to be improper piece meal analysis of the references.

Appellants argue that the instant invention is not obvious over the Stickler reference relative to the combination with Reynolds and Grosse.

This is not persuasive for the same reason given above.

Appellants argue against all of the references individually. It is noted that none of the references teach all of the limitations of the claims individually. It is further noted that these are 103 combination rejections and not 102 rejections based on a single reference. It is noted that further still appellants have failed to argue as to why the proposed combination is improper, instead of arguing improper piece meal analysis of the references.

Claim 32, directed to...

Appellants argue that Krivohlavek is not relevant to the solution of the problem of the invention according to the appellants, in other words, the reference is nonanalogous art .

This is not persuasive because again it offers no teaching evidence or suggestion that would have led one of ordinary skill in the art to believe that there was no expectation for success, but only offers mere allegation, and does not specifically state why it is nonanalogous art.

Appellants argue against the reference of Krivohlavek individually, which is considered to be improper piece meal analysis of the references, as there is no teaching or suggestion offered from the references that the combination would not work or would not be attempted.

Although, most of these arguments are considered to be improper piece meal analysis, Appellant's argument that "2. the use of such an emulsion in rocket propulsion would result in de-mixing when fed into the combustion chamber"

Here it is noted that the rejections and reference pertain to solid rockets, so there would be no feeding into the combustion chamber, it appears appellants have mischaracterized the instant invention and the rejections.

Claim 18 is directed to...

These arguments have been fully considered but are not persuasive for the same reasons given above.

Claim 42, directed to...

These arguments have been fully considered but are not persuasive for the same reasons given above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

James Eric McDonough, Junior Examiner, Art unit 1793

/James Eric McDonough/

Conferees:

Jerry Lorengo

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